For Users of the DOE-2, PowerDOE, and SPARK Programs

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THE USER NEWS

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* * * Keywords!! * * * *

* DOE-2 Training • Beginners Only!

A 3-day DOE-2 beginner's course will be given June 14-16 at the Southern California Gas Company's Energy Resorce Center in Downey, CA. The class will be taught by Marlin Addison of Energy Simulation Specialists of Tempe, AZ. Cost of the course is $395. Enrollment is limited; to register, call 1-800-427-6584 or fax your request to (310) 803-7551.

* More Resource Centers!

There are two new DOE-2 Resource Centers: Barath & Wagner, a large mechanical engineering company in Germany, and ACADS-BSG, a non-profit group of computer users in Australia. Full names and addresses are on p.43.

* MICRO-DOE2 Has Moved! - Part II

In the last issue of the newsletter, we gave you the new address and phone number for ERG/Acrosoft (the vendors of MICRO-DOE2). And in THIS issue, we're printing the *correct* new phone and fax numbers: Phone: (303) 904-3233, Fax: (303) 904-3234. Sorry for the error.

* WWW + EE = WOW!!

Many sites on the World-Wide Web contain information on how to create energy efficient buildings. In this issue, we feature three internet addresses, also called Uniform Resource Locators (URLs): one for the California Energy Commission on p.42, one for the International Commission of Illumination (CIE) on p.44, and one for the Energy Efficiency and Renewable Energy Network (EREN) of the U.S. Dept. of Energy on p.44. An excellent article about the World-Wide Web appeared in the March/April issue of Home Energy Magazine (see p.41-47, article written by Rob Penney of the Washington State Energy Office).

Home Energy Magazine continues to be a fine resource for energy simulation specialists. For subscription information, contact Home Energy Magazine, 2124 Kittredge Street, No. 95, Berkeley, CA 94704; Phone (510) 524-5405.

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The User News is written by members of the Simulation Research Group. Direct suggestions, comments or submissions to Kathy Ellington, Editor, MS: 90-3147, Lawrence Berkeley Laboratory, Berkeley, CA 94720. Fax (510)486-4089/email kathy%gundog@lbl.gov

THE HEAT EXCHANGER – PART I

Metric Unit Values for the ENERGY–RESOURCE Command

by

Rene' Meldem

Question: I did a metric DOE-2.1E run and the numbers in Plant reports PS–B (Monthly Utility and Fuel Use Summary) and PS–F (Energy Resource Peak Breakdown by End Use) made no sense whatsoever.

Answer: The problem is a bug in the program when metric units are used. The work-around is to input an ENERGY–RESOURCE command for each energy resource being considered in your building (see DOE-2 *Supplement (2.1E)*, p.4.5-4.7). Examples for various resources (natural gas, steam, chilled water, etc.) are shown below. Note that, even though you are dealing with metric input, the units for the ENERGY/UNIT keyword are Btu/unit, not Wh/unit.

Plant ENERGY–RESOURCE Commands for Metric Input

```
ENERGY-RESOURCE
RESOURCE = NATURAL-GAS
ENERGY/UNIT = 37102.34              $  BTU/M3, based on 1M3 = 10.871 kWh $
UNIT-NAME = M3
DEM-UNIT-NAME = M3/H ..

ENERGY-RESOURCE
RESOURCE = STEAM
ENERGY/UNIT = 3413000               $ BTU/MWh   $
UNIT-NAME = MWH
DEM-UNIT-NAME = MW ..

ENERGY-RESOURCE
RESOURCE = CHILLED-WATER
ENERGY/UNIT = 3413000               $ BTU/MWh   $
UNIT-NAME = MWH
DEM-UNIT-NAME = MW ..

ENERGY-RESOURCE
RESOURCE = ELECTRICITY
ENERGY/UNIT = 3413                  $ BTU/kWh   $
UNIT-NAME = KWH
DEM-UNIT-NAME = KW ..

ENERGY-RESOURCE
RESOURCE = LPG
ENERGY/UNIT = 25198.18              $ BTU/liter based on 7.383 kWh/liter $
UNIT-NAME = LITERS
DEM-UNIT-NAME = LITERS/HR ..
```

```
ENERGY-RESOURCE
RESOURCE = FUEL-OIL
ENERGY/UNIT = 36597.6              $ BTU/liter based on 10.723 kWh/liter $
UNIT-NAME = LITERS
DEM-UNIT-NAME = LITERS/HR ..

ENERGY-RESOURCE
RESOURCE = DIESEL-OIL
ENERGY/UNIT = 36597.6              $ BTU/liter based on 10.723 kWh/liter $
UNIT-NAME = LITERS
DEM-UNIT-NAME = LITERS/HR ..

ENERGY-RESOURCE
RESOURCE = COAL
ENERGY/UNIT = 27100.6              $ BTU/kg based on 7.94 kWh/kg $
UNIT-NAME = KILOS
DEM-UNIT-NAME = KILOS/HR ..

ENERGY-RESOURCE
RESOURCE = METHANOL
ENERGY/UNIT = 16754.4              $ BTU/liter based on 4.909 kWh/liter $
UNIT-NAME = LITERS
DEM-UNIT-NAME = LITERS/HR ..

ENERGY-RESOURCE
RESOURCE = OTHER-FUEL
ENERGY/UNIT = 3413                 $ BTU/kWh   $
UNIT-NAME = KWH
DEM-UNIT-NAME = KW ..
```

DOE-2 Program Documentation

Document	Order Number	Price
DOE-2 Basics Manual (2.1E)	DE-940-13165	44.50
BDL Summary (2.1E)	DE-940-11217	27.00
Sample Run Book (2.1E)	DE-940-11216	91.00
Reference Manual (2.1A)	LBL-8706, Rev.2	126.00
Supplement (2.1E)	DE-940-11218	91.00
Engineers Manual (2.1A) [algorithm descriptions]	DE-830-04575	52.00

Order from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Phone (703) 487-4650
FAX (703) 321-8547

THE HEAT EXCHANGER – PART II

Switch-off Dimming System

by
Fred Winkelmann

Question: How can I model a continuous dimming system in DOE-2 in which the lights dim to some low value and then turn off? The option LIGHT–CTRL–TYPE1 (or LIGHT–CTRL–TYPE2) = CONTINUOUS dims to MIN–LIGHT–FRAC and MIN–POWER–FRAC but stays at those values if the daylight illuminance increases. Instead, I want the lights to turn off completely at this point because this reduces electricity use.

Answer: An Input Function that does this has been devised by Monica Bosler of Consulting Engineers, Inc., Tulsa, OK. An example of the function (for one daylighting reference point) is as follows. The same function will also work for two reference points.

```
INPUT LOADS ..
...
SPACE-1    =SPACE
             ...
             DAYLIGHTING = YES
             LIGHT-REF-POINT1 = (24,24,2.5)
             LIGHT-SET-POINT1 = 60
             LIGHT-CTRL-TYPE1 = CONTINUOUS
             ZONE-FRACTION1   = 1.0
             MIN-LIGHT-FRAC   = 0.10
             MIN-POWER-FRAC   = 0.283
             DAYL-LTCTRL-FN   = (*NONE*,*SWITCH-OFF*) ..
...
END ..
FUNCTION  NAME = SWITCH-OFF ..
ASSIGN    MPF   = MIN-POWER-FRAC $ min power fraction
          PRF   = POWER-RED-FAC  $ power reduction factor
          NREFP= NREFP           $ number of reference points
          ZF1   = ZONE-FRACTION1 $ fraction of zone for 1st ref pt
          ZF2   = ZONE-FRACTION2 $ fraction of zone for 2nd ref pt
          FP1   = FPHRP1         $ power fraction for 1st ref pt
          FP2   = FPHRP2 ..      $ power fraction for 2nd ref pt
CALCULATE ..
      IF(FP1.LE.MPF) FP1 = 0
      PRF = FP1*ZF1 + 1 - ZF1
      IF(NREFP.LT.1.5) RETURN
      IF(FP2.LE.MPF) FP2 = 0
      PRF = PRF + FP2*ZF2 - ZF2
      END
END-FUNCTION ..
COMPUTE LOADS ..
...
```

Note: if there are two reference points, this function requires that both LIGHT–CTRL–TYPE1 and LIGHT–CTRL–TYPE2 = CONTINUOUS. In a future version of DOE-2 this type of control will be added as LIGHT–CTRL–TYPE1 (or LIGHT–CTRL–TYPE2) = CONTINUOUS/OFF.

Changing the Holiday List in DOE-2

by
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Introduction

In full hour-by-hour building energy simulation programs like DOE-2, there is usually a holiday list to represent the general holidays of the calendar year under consideration. In DOE-2, the holiday list is designated by default as the ten official holidays of the United States [Ref. 1].

Up to and including the DOE-2.1D version, it was not possible to change the holiday list without modifying the FORTRAN source code [Ref. 2]. This was inconvenient for those of us working on simulation exercises in other countries and made it impossible to assess the effects of holidays on building energy simulation and analysis.

This problem was recognized by the program developers and in the latest release (DOE-2.1E) a new command "ALT–HOLIDAYS" was introduced. It allowed non-U.S. program users to change the default U.S. holiday list [Ref. 1]. It took a "month-day" pair like the RUN–PERIOD command and allowed an input of up to 40 pairs in each run [Ref. 3].

However, if you want to prepare a BDL input file for simulations with a number of different calendar years, you might want to define a set of general relationships for your own local holidays; ALT–HOLIDAYS was not flexible enough to meet these needs. To tackle these problems, we used "user-defined input functions" to change the holiday list and to offer a flexible way of defining the holidays. The author has prepared some simple input functions for Hong Kong and has tested them with both the "D" and "E" versions of DOE-2. Holiday adjustments are important to the simulation results because the internal loads (occupancy, lighting and equipment), which are essential components of building energy consumption, are directly affected by the changes in day schedule.

Methodology

The Input Function feature, first introduced in DOE-2.1D, allows you to modify DOE-2 LOADS and SYSTEMS calculations without recompiling the program [Ref. 1]. However, before writing the input functions and making them work, you must understand the simulation variables, algorithms and locations of the final calculations. This can best be done by examining the simplified program flowcharts and algorithms of DOE-2 [Ref. 1 & 4]. However, there is no guarantee that you can modify every variable in the way you want and perform the desired changes to the simulation procedures. Careful examination of the hourly reports from DOE-2 are often needed to see if the desired results can be achieved. Fortunately, with a number of trials (and errors), the author has created the input functions for changing the holiday list for Hong Kong.

To define your own holiday list, you should note the schedules that will be affected by the day schedule (values from 1 to 8). The day schedule defines weekdays (1 to 7 for Sunday to Saturday) and holiday (8); it is determined by the "HOLIDA" subroutine in LOADS subprogram.

Two input functions are introduced in the hourly loop to carry out the changes:

(1) HOLIDAY test for and change every schedule value on a holiday.

(2) HOLRESET reset schedule values of holidays if they have been changed by HOLIDAY.

You must set the HOLIDAY keyword in the BUILDING–LOCATION command to "NO" and declare the above two functions under this command so that they are called as "building before" and "building after" functions respectively. The command can be written like this:

```
B-L    ALT=33 G-A=49000 HOL=NO D-S=NO AZ=0
       FUNCTION=(*HOLIDAY*,*HOLRESET*) ..
```

It should be noted that not all variables are passed between the LOADS, SYSTEMS and PLANT programs in DOE-2 [Ref. 5]. If the BDL input file also has SYSTEMS and PLANT sections, it is essential that similar input functions are specified respectively in those sections. For SYSTEMS, the location of the input functions is important; it is necessary to place the first user function as "plant before" function and the second reset function as "system after" function. For example, the command lines can be written like this:

```
SYST-1      =SYSTEM    S-TYPE=SYS-TYPE   S-C=SYS-CTRL   S-A=SYS-AIR
                       S-FANS=SYS-FAN   S-T=SYS-TERM  R-A-P=DUCT
                       Z-N=(SP-N,SP-E,SP-S,SP-W,SP-I,CORE,
                            RFSP-N,RFSP-E,RFSP-S,RFSP-W,RFSP-I,RFCORE,
                            GFSP-N,GFSP-E,GFSP-S,GFSP-W,GFSP-I,GFCORE,)
                       HEAT-S=ELECTRIC   Z-H-S=ELECTRIC
                       S-O=COINCIDENT   S-R=1

                $ Add HOLRES2 in SYSTEM after loop
                       FUNCTION=(*NONE*,*HOLRES2*)   ..

PLT-1       =P-A       S-N=(SYST-1)

                $ Add HOLLID2 in PLANT begin loop
                       FUNCTION=(*HOLID2*,*NONE*)   ..
```

Holidays for Hong Kong

It is rather difficult to define a general set of equations for the public holidays in Hong Kong because there are holidays from the Western culture (such as Christmas and Easter) as well as from traditional Chinese culture (such as Chinese New Year and Dragon Boat Festival). Chinese holidays follow the lunar calendar and their calculations are not simple and straight-forward under the normal calendar.

The rules for determining the general holidays in Hong Kong and the dates of the holidays for the past decades have been studied [Refs. 6 and 7]. There are a total of 17 public holidays in Hong Kong each year (excluding Sundays). The number is greater than that for the default U.S. holidays (10 holidays only). But it should be noted that 5-day week is common in the United States, whereas 5-and-a-half day and 6-day weeks are common in Hong Kong.

A user function in DOE-2 has been established to determine the general holidays of Hong Kong for the years 1979 to 1993. The holiday list will be changed according to the year of simulation under consideration. An abstracted version of the input functions is shown in the Appendix. The first part is the "HOLIDAY" input function and the second part is the "HOLRESET" function.

The user functions were tested with both the "D" and "E" versions of DOE-2. They may be modified to change the holiday list for other locations. The basic syntax for writing the user functions is very similar to that of writing in FORTRAN.

Effects of Adjusting the Holidays

The effects of changing the default U.S. holidays to the Hong Kong local holidays were studied by carrying out DOE-2 simulations on a model office building (see [Ref. 8] for details of the model building). Weather data files in TMY format for the 15 years from 1979 to 1993 were used in the study and DOE-2.1D was used for the energy simulations.

Because all the weather files have 365 days, if a leap year is encountered then the 29th day of February is skipped, instead of the 31st day of December, so that the dates in the year are always correctly indicated. (If "Dec 31" is skipped there will be one-day difference after Feb 29, i.e. Feb 29 becomes Mar 1 and so on.)

Table 1 below shows a summary of the DOE-2 simulation results. You can see that the average difference in total annual building energy consumption between the two sets of holidays is about 1.7 percent. The variations of the differences in the 15-year period are from 0.8 percent to 2.6 percent.

TABLE 1. Comparison of Simulation Results for Adjusting HK Holidays

Year	Number of Holidays in Hong Kong	Annual Building Energy Consumption (MWh) Using US Holidays	Using HK Holidays	Diff in MWh	Diff in %
1979	17	8051.31	7917.63	133.68	1.7%
1980	17	8108.76	7968.07	140.69	1.7%
1981	17	8165.05	7951.06	213.99	2.6%
1982	17	8074.10	7882.17	191.93	2.4%
1983	17	8070.80	7936.23	134.57	1.7%
1984	17	8221.65	8079.60	142.05	1.7%
1985	17	7957.48	7862.63	94.85	1.2%
1986	18*	7986.03	7884.36	101.67	1.3%
1987	17	8033.17	7885.50	147.67	1.8%
1988	17	8282.70	8140.24	142.46	1.7%
1989	17	8071.08	7909.31	161.77	2.0%
1990	17	8115.57	7991.60	123.97	1.5%
1991	17	8216.15	8066.72	149.43	1.8%
1992	17	8049.94	7876.07	173.87	2.2%
1993	17	8108.63	8047.40	61.23	0.8%
Average	17	8100.83	7959.91	140.92	1.7%

* = One additional holiday on Wednesday, October 22, 1986, for Queen's visit to HK.

The holiday list has significant influence on the simulation results because the internal loads (occupancy, lighting and equipment) and the system operation are directly affected by the changes in day schedule. It is essential that the same set of holidays is employed for comparative energy studies. It is also necessary to be aware of the variations in day schedule when comparing the simulation results for different calendar years at different locations.

Conclusion

The example demonstrated here for Hong Kong can be modified to change the holiday list for other locations. There is also the potential for creating input functions in a similar way to solve a wide range of problems associated with day schedule.

The "holidays" problem can be one of the sources that accounts for the difference in the simulation results. If we want to make sure that our comparison and validation are drawn on a fair basis, greater effort and care are required by modelers to look carefully on the calendar and day schedule under which the simulations are performed.

Acknowledgements

The author would like to thank Ellen Franconi and Fred Buhl of Lawrence Berkeley Laboratory for their useful advice and discussions. It is hoped that they can enjoy every one of their "holidays" no matter where they are!

References

[1] "DOE-2 Supplement (2.1E)", LBL-34947, Lawrence Berkeley Laboratory, November 1993.

[2] "DOE-2 Basics (2.1D)", LBL-29140, pp. 3.5, Lawrence Berkeley Laboratory, August 1991.

[3] "DOE-2 BDL Summary Version 2.1E", LBL-34946, pp. 8, Lawrence Berkeley Laboratory, November 1993.

[4] "DOE-2.1D Source Code Tape", Lawrence Berkeley Laboratory, 1990, (Complier listing of subroutines including the files LDS.DOC and SYS.DOC)

[5] Private e-mail communications with Ellen Franconi, 1994.

[6] "Holidays Ordinance", Chapter 149, Laws of Hong Kong, Revised Edition 1983, Government Printer Hong Kong.

[7] "Hong Kong $ Directory" (annual publication), 1979 to 1993 editions, Local Printing Press Ltd., Hong Kong.

[8] Lam, J.C. and Hui, S.C.M., Computer simulation of energy performance of commercial buildings in Hong Kong, In Proc. Building Simulation '93 Conference, August 16-18, 1993, Adelaide (Australia), pp. 129-135, The International Building Performance Simulation Association, 1993.

Appendix

```
$-------------------------------------------------------------------------
$ Function to reset the holiday list in DOE-2 for Hong Kong
$ (the relevant load schedules will be changed)
$-------------------------------------------------------------------------
FUNCTION NAME=HOLIDAY  ..

ASSIGN
       IDOW=IDOW
       IYR=IYR
       IMO=IMO
       IDAY=IDAY
       ISCHR=ISCHR
       ISCDAY=ISCDAY
       OCC=SCHEDULE-NAME(OCC-SCH)
       LTP=SCHEDULE-NAME(LGP-SCH)
       LTI=SCHEDULE-NAME(LGI-SCH)
       EQ1=SCHEDULE-NAME(EQP-SCH)
       INF=SCHEDULE-NAME(INF-SCH)
       XXX90=XXX90
       XXX91=XXX91
       XXX92=XXX92
       XXX93=XXX93
       XXX94=XXX94
       XXX95=XXX95  ..

CALCULATE  ..

C-------------- Set the schedule day to the day of the week
       ISCDAY=IDOW

C-------------- Set indicator to zero
       XXX90=0

C-------------- Skip if it is a Sunday
       IF (IDOW .EQ. 1)  GOTO 1000

C-------------- Determine which year is concerned
 50    IF (IYR .EQ. 1979)  GOTO 79
       IF (IYR .EQ. 1980)  GOTO 80
       IF (IYR .EQ. 1981)  GOTO 81
       IF (IYR .EQ. 1982)  GOTO 82
       IF (IYR .EQ. 1983)  GOTO 83
       IF (IYR .EQ. 1984)  GOTO 84
       IF (IYR .EQ. 1985)  GOTO 85
       IF (IYR .EQ. 1986)  GOTO 86
       IF (IYR .EQ. 1987)  GOTO 87
       IF (IYR .EQ. 1988)  GOTO 88
       IF (IYR .EQ. 1989)  GOTO 89
```

```
      IF (IYR .EQ. 1990)  GOTO 90
      IF (IYR .EQ. 1991)  GOTO 91
      IF (IYR .EQ. 1992)  GOTO 92
      IF (IYR .EQ. 1993)  GOTO 93
      GOTO 1000

C-------------------------------------------------------------------------
C------------- Chinese holidays in each year include:
C------------- (1)  1st day of Chinese New Year
C------------- (2)  2nd day of Chinese New Year
C------------- (3)  3rd day of Chinese New Year
C------------- (4)  Ching Ming Festival
C------------- (5)  Tuen Ng (Dragon Boat) Festival
C------------- (6)  Day following Mid-Autumn Festival (or Mid-Autumn
C-------------       if the day following is a Sunday)
C------------- (7)  Chung Yeung Festival

C------------- Easter holidays:
C------------- (1)  Good Friday
C------------- (2)  Day following Good Friday
C------------- (3)  Easter Monday

C------------- Queen's birthday
C------------- a) For years 1979 - 1982:
C-------------     (1)  Queen's birthday (21 Apr or another day
C-------------          appointed in April)
C------------- b) For years 1983 - 1993:
C-------------     (1)  Queen's birthday (2nd or 3rd Saturday in June)
C-------------     (2)  Monday following Queen's birthday

C------------- Total nos. of general holidays:
C------------- a) For years 1983-1993 =  17 days
C------------- b) For years 1979-1982 =  16 days
C------------- (* There is one additional holiday for Queen's visit
C-------------     to HK in 1986)
C-------------------------------------------------------------------------

 79   IF (IMO .EQ. 1 .AND. IDAY .EQ. 29)  GO TO 500
      IF (IMO .EQ. 1 .AND. IDAY .EQ. 30)  GO TO 500
      IF (IMO .EQ. 1 .AND. IDAY .EQ. 31)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 5)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 13)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 14)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 16)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 21)  GO TO 500
      IF (IMO .EQ. 5 .AND. IDAY .EQ. 30)  GO TO 500
      IF (IMO .EQ. 10 .AND. IDAY .EQ. 6)  GO TO 500
      IF (IMO .EQ. 10 .AND. IDAY .EQ. 29)  GO TO 500
      GOTO 200
```

```
....
.... {*** Other years from 1980 to 1992 are included here}
....
....


93    IF (IMO .EQ. 1 .AND. IDAY .EQ. 22)  GO TO 500
      IF (IMO .EQ. 1 .AND. IDAY .EQ. 23)  GO TO 500
      IF (IMO .EQ. 1 .AND. IDAY .EQ. 25)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 5)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 9)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 10)  GO TO 500
      IF (IMO .EQ. 4 .AND. IDAY .EQ. 12)  GO TO 500
      IF (IMO .EQ. 6 .AND. IDAY .EQ. 12)  GO TO 500
      IF (IMO .EQ. 6 .AND. IDAY .EQ. 14)  GO TO 500
      IF (IMO .EQ. 6 .AND. IDAY .EQ. 24)  GO TO 500
      IF (IMO .EQ. 10 .AND. IDAY .EQ. 1)  GO TO 500
      IF (IMO .EQ. 10 .AND. IDAY .EQ. 23)  GO TO 500
      GOTO 210

C-------------------------------------------------------------------------
C------------- General holidays in every year
C-------------------------------------------------------------------------

C------------- For years 1979 to 1982
C------------- (1)  1st weekday in July
C------------- (2)  1st Monday in August
 200  IF (IMO .EQ. 7 .AND. IDAY .EQ. 1 .AND. IDOW .NE. 1)  GOTO 500
      IF (IMO .EQ. 7 .AND. IDAY .EQ. 2 .AND. IDOW .EQ. 2)  GOTO 500
      IF (IMO .EQ. 8 .AND. IDAY .LE. 7 .AND. IDOW .EQ. 2)  GOTO 500

      GOTO 250

C------------- For years 1983 to 1993
C------------- (1)  Saturday preceding the last Monday in August
 210  IF (IMO .EQ. 8 .AND. IDAY .GE. 23 .AND. IDAY .LE. 29
     1 .AND. IDOW .EQ. 7)  GOTO 500

C------------- General holidays for all years from 1979 to 1993
C------------- (1)  1st weekday in Jan
C------------- (2)  Xmas day (or 2nd weekday after if Xmas on Sunday)
C------------- (3)  1st weekday after Xmas day
C------------- (4)  Liberation day (the last Monday in August)
 250  IF (IMO .EQ. 1 .AND. IDAY .EQ. 1 .AND. IDOW .NE. 1)  GOTO 500
      IF (IMO .EQ. 1 .AND. IDAY .EQ. 2 .AND. IDOW .EQ. 2)  GOTO 500
      IF (IMO .EQ. 12 .AND. IDAY .EQ. 25 .AND. IDOW .NE. 1)  GOTO 500
      IF (IMO .EQ. 12 .AND. IDAY .EQ. 26 .AND. IDOW .NE. 1)  GOTO 500
      IF (IMO .EQ. 12 .AND. IDAY .EQ. 27 .AND. (IDOW .EQ. 2
     1 .OR. IDOW .EQ. 3))  GOTO 500
      IF (IMO .EQ. 8 .AND. IDAY .GE. 25 .AND. IDOW .EQ. 2)  GOTO 500
```

```
      GOTO 1000

 500  ISCDAY=8

C-------------- Store original schedule values in static arrays
      XXX90=1
      XXX91=OCC
      XXX92=LTP
      XXX93=LTI
      XXX94=EQ1
      XXX95=INF

C-------------- Override schedule values for a holiday
      EQ1=.02
      INF=1
      OCC=.05
      LTP=.1
      LTI=.1

      IF (ISCHR .LT. 7 .OR. ISCHR .GT. 18) GOTO 700

 600  GOTO 1000

 700  OCC=0
      LTP=.05
      LTI=.05

1000  CONTINUE
      END

END-FUNCTION  ..

$-------------------------------------------------------------------------
$ Function to reset schedule values if it was changed
$-------------------------------------------------------------------------
FUNCTION NAME=HOLRESET  ..

ASSIGN
      IDOW=IDOW
      IYR=IYR
      IMO=IMO
      IDAY=IDAY
      ISCHR=ISCHR
      ISCDAY=ISCDAY
      OCC=SCHEDULE-NAME(OCC-SCH)
      LTP=SCHEDULE-NAME(LGP-SCH)
      LTI=SCHEDULE-NAME(LGI-SCH)
      EQ1=SCHEDULE-NAME(EQP-SCH)
      INF=SCHEDULE-NAME(INF-SCH)
      XXX90=XXX90
```

```
      XXX91=XXX91
      XXX92=XXX92
      XXX93=XXX93
      XXX94=XXX94
      XXX95=XXX95   ..

CALCULATE   ..

C-------------- Reset schedule values if they are changed
      IF (XXX90 .EQ. 1) GOTO 10
      GOTO 20

10    OCC=XXX91
      LTP=XXX92
      LTI=XXX93
      EQ1=XXX94
      INF=XXX95

20    CONTINUE

C-------------- If leap year, up one weekday on last hour of Feb 28
1000  IF ((IYR .EQ. 1980 .OR. IYR .EQ. 1984 .OR. IYR .EQ. 1988 .OR.
     1 IYR .EQ. 1992) .AND. IMO .EQ. 2 .AND. IDAY .EQ. 28 .AND.
     2 ISCHR .EQ. 24)   GOTO 1100
      GOTO 1200

1100  IDOW = IDOW + 1

1200  CONTINUE

C-------------- Diagnostic print-out for checking
C      PRINT 1300
C1300  FORMAT(21H TEST OF RESET FUNCTION)
C      PRINT 1400, IMO,IDAY,ISCHR,IDOW,ISCDAY
C1400  FORMAT(1X,5F10.1)

      END

END-FUNCTION   ..
```

• • DOE-2.1E Documentation Errata • •

Listed below are corrections and additions to the DOE-2.1E documentation. The changes affect the BDL Summary (2.1E), DOE-2 Basics (2.1E), and the Supplement (2.1E). Please contact Kathy Ellington (Ph 510-486-5711 or Fax 510-486-4089) if you have modifications to this list.

Corrections to DOE-2 BASICS (2.1E)

In the SYSTEMS Section

Page No.	Correction
3.69	Under the ZONE–AIR command, add this sentence to the description of OA-CFM/PER: The minimum outside air flow rate can be scheduled using the MIN–AIR–SCH keyword in the SYSTEM–AIR command. See p.80.

Corrections to the BDL SUMMARY (2.1E)

In the LOADS Section

Page No.	Keyword	Correction
Under the command **EXTERIOR–WALL or ROOF**		
P.19	TILT	Default is 90 degree tilt. Change comment to read: [Tilt for ROOF must be input; otherwise defaults to 90°]
P.19	INF–COEF	Change note at bottom of command to read: Used only if INF–METHOD = CRACK in SPACE or SPACE–CONDITIONS
Under the command **WINDOW**		
P.21	INF–COEF	Change note at bottom of command to read: Used only if INF–METHOD = CRACK in SPACE or SPACE–CONDITIONS
Under the command **LOADS–REPORT**		
P.25	HOURLY–DATA–SAVE	Change code-word NO to NO–SAVE

Corrections to the BDL SUMMARY (2.1E) (continued)

In the SYSTEMS Section

Page No.	Command/Keyword	Correction
Under the command **SYSTEM–FANS**		
P.34	SUPPLY–KW	Change range to 0.0 to 0.1 kW/cfm
Under the command **SYSTEM–EQUIPMENT**		
P.36	OUTSIDE–FAN–ELEC	Abbreviation is O–F–ELEC; range should be 0.0 to 0.1 W/kW
Under the command **SUBR–FUNCTIONS**		
P.42	CONCHN	Should be CONCHN–1
P.42	DESIGN	Should be DESIGN–1
P.42	FANPWR	Should be FANPWR–1
P.42	FTDEV	Should be FTDEV–1
P.42	FURNAC	Should be FURNAC–1
P.42	HE	Should be HE–1
P.42	HOURIN	Should be HOURIN–1
P.42	HPUNIT	Should be HPUNIT–1
P.42	OPSTRT	Should be OPSTRT–1
P.42	RESVVT–0	Add keyword
P.42	RESVVT–1	Add keyword
P.42	RESVVT–2Z	Add keyword
P.42	RESVVT–3	Add keyword
P.42	RESVVT–4	Add keyword
P.42	SSBASB	Should be SSBASB–1
P.42	SSFCOR	Should be SSFCOR–1
Under the command **PLANT–ASSIGNMENT**		
P.43	HP–LOOP–HEATING	Add code-word FROM–GROUND
P.43	HP–LOOP–COOLING	Add code-word FROM–GROUND
P.43	GLOOP–TEMP–SCH	Add new keyword. GLOOP–TEMP–SCH accepts a schedule of ground temperatures in °F with a default of the weather file ground temperatures (or those specified in LOADS)
Under the command **PLANT–ASSIGNMENT**		
P.44	DHW–TYPE	Code-words are "(GAS; ELECTRIC, HEAT–PUMP, DESUPERHEAT, WASTE–HEAT)", not just "GAS".
Under the command **SYSTEMS–REPORT**		
P.46	HOURLY–DATA–SAVE	Change code-word NO to NO–SAVE

Corrections to the BDL SUMMARY (2.1E) (continued)

In the PLANT Section

Page No.	Command/Keyword	Correction
Under the command **PLANT–EQUIPMENT**		
P.48	TYPE	Add COOLING–TWR to the list of code-words (COOLING–TWR is the same as OPEN–TWR)
Under the command **PLANT–PARAMETERS**		
P.51	OPEN–CENT–COND–PWR	Default should be 0.028
P.51	OPEN–REC–COND–PWR	Default should be 0.028
P.51	HERM–CENT–COND–PWR	Default should be 0.028
P.51	HERM–REC–COND–PWR	Default should be 0.028
P.53	MIN–TWR–WTR–T	Default should be 65.0
Under the command **EQUIPMENT–QUAD**		
P.55	ABSOR1–HIR–FPLR	Add: See *Supplement (2.1E)*, page C.129, Report PV–G for default curve coefficients
P.55	ABSOR2–HIR–FPLR	Add: See *Supplement (2.1E)*, page C.129, Report PV–G for default curve coefficients
P.55	ABSORG–HIR–FPLR	Add: See *Supplement (2.1E)*, page C.129, Report PV–G for default curve coefficients
Under the command **HEAT–RECOVERY**		
P.56	DIESEL–TRACK–MOD	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	COGEN–TRACK–MODE	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	COGEN–TRACK–SCH	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	DBUN–MIN–HEAT	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
Under the command **LOAD–ASSIGNMENT**		
P.56	DIESEL–TRACK–MOD	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	COGEN–TRACK–MODE	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	COGEN–TRACK–SCH	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	DBUN–MIN–HEAT	Delete keyword. This keyword is now found under PLANT–PARAMETERS.
P.56	NUMBER	In the comment for this keyword, change MBtu to MBtu/hr.
Under the command **ENERGY–RESOURCE**		
P.58	RESOURCE	Add FUEL–OIL to list of code-words

Corrections to the BDL SUMMARY (2.1E) (continued)

In the SYSTEM TYPES Section

Page No.	Command/Keyword	Correction
P.88	Cross out the heading "ZONE–Level Commands and Keywords"	
Under the command **SYSTEM**		
P.94	HEAT–SOURCE	Change GAS–FURNACE to FURNACE
Under the command **SYSTEM–EQUIPMENT**		
P.95	RES–EVAP–COOLER	Add keyword; default is NO
P.95	RES–EVAP–CL–CFM	Add keyword; default is NO
P.95	OUTSIDE–FAN–T	Default should be °F
P.95	OUTSIDE–FAN–KW	Change keyword to OUTSIDE–FAN–ELEC
Under the command **SYSTEM**		
P.97	HEAT–SOURCE	Code-word should be FURNACE, not GAS–FURNACE
Under the command **SYSTEM–EQUIPMENT**		
P.98	OUTSIDE–FAN–KW	Change keyword to OUTSIDE–FAN–ELEC
P.100	SYSTEM–EQUIPMENT	Add: See p.115 and 115a
P.101	SYSTEM–EQUIPMENT	Add: See p.115 and 115a
Under the command **SYSTEM**		
P.107	HEAT–SOURCE	Default is GAS-FURNACE
P.107	ZONE–HEAT–SOURCE	Default is ELECTRIC
P.107	RETURN–AIR–PATH	Default is DUCT
Under the command **SYSTEM–AIR**		
P.107	OA–CONTROL	Add keyword; default is TEMP
P.107	MIN–OUTSIDE–AIR	Change default to 0.0100
P.107	MAX–OA–FRACTION	Add keyword; default is 1.0000
P.107	VENT–METHOD	Add keyword; default is AIR–CHANGE
P.107	VENT–TEMP–SCH	Add keyword; default is no natural ventilation
P.107	NATURAL–VENT–AC	Add keyword; default is no natural ventilation
P.107	NATURAL–VENT–SCH	Add keyword; default is no natural ventilation
P.107	OPEN–VENT–SCH	Add keyword; default is no natural ventilation
P.107	MAX–VENT–RATE	Add keyword; default is 20.0000
P.107	HOR–VENT–FRAC	Add keyword; default is 0.0000
P.107	FRAC–VENT–AREA	Add keyword; default is 0.0500

Corrections to the BDL SUMMARY (2.1E) (continued)

In the SYSTEM TYPES Section

Page No.	Command/Keyword	Correction
Under the command **SYSTEM–FANS**		
P.107	SUPPLY–DELTA–T	Default is 2.80F
P.107	SUPPLY–KW	Default is 0.0009 kW/cfm
P.107	INDOOR–FAN–MOD	Add keyword; default is INTERMITTENT
P.107	RETURN–DELTA–T	Add keyword; default is No return fan
P.107	RETURN–KW	Add keyword; default is No return fan
Under the command **SYSTEM–EQUIPMENT**		
P.107	EVAP–CL–AIR	Add keyword; default is 1.0000
P.107	EVAP–CL–KW	Default is 0.0001 kW/cfm
P.107	FURNACE–AUX	Add keyword; default is 800.0
P.107	FURNACE–HIR	Add keyword; default is 1.35
P.107	FURNACE–HIR–FPLR	Add keyword; default is curve SDL-C111
P.107	HEATING–CAPACITY	Required keyword
P.107	HEAT–CAP–FT	Default is curve SDL-C51
P.107	HEATING–EIR	Default is 0.3700
P.107	HEAT–EIR–FT	Default is curve SDL-C56
P.107	HEAT–EIR–FPLR	Add keyword; default is curve SDL-C61
P.107	FURNACE–AUX–KW	Add keyword; default is 0.0000
P.107	HEAT–EXCH–EFF	Add keyword; default is 0.7000
P.107	HEAT–EXCH–DELP	Add keyword; default is 1.0000
P.107	DIRECT–EFF–FLOW	Add keyword; default is curve SDL-C58
P.107	INDIR–EFF–FLOW	Add keyword; default is curve SDL-C59
Under the command **SYSTEM–EQUIPMENT**		
P.108	SYSTEM–EQUIPMENT	Add: See p.115 and 115a
P.115	MIN–HBG–RATIO	Change default to 0.0

Corrections to the SUPPLEMENT (2.1E)

In the BDL Section

Page No.	Correction
1.3	Delete the line that starts, "2) the *Cross-Reference Listing of LOADS...*"
1.3	Delete the line that starts, "4) the *Subroutine Call Tree,...*"
1.3	Delete the paragraph that starts, "These four listings are..." and replace with this paragraph: These listings are available as four print files on the program release tape; they reside in these files: LDS–LIS.DOC, LDS–VAR.DOC, SYS–LIS.DOC, and SYS–VAR.DOC. Print out these files if you plan to use Input Functions. *These tools are essential to the use of the feature; if you do not fully understand the calculation sequence in DOE-2, it is very easy to enter functions that change the DOE-2 results in unexpected ways.* See also the LOADS and SYSTEMS sections of the *Engineers Manual (2.1A)* for detailed algorithm descriptions.
1.6	Change CONCHN to CONCHN–1
1.6	Change DESIGN to DESIGN–1
1.6	Change FANPWR to FANPWR–1
1.6	Change FTDEV to FTDEV–1
1.6	Change FURNAC to FURNAC–1
1.6	Change HE to HE–1
1.6	Change HOURIN to HOURIN–1
1.6	Change HPUNIT to HPUNIT–1
1.6	Change OPSTRT to OPSTRT–1
1.6	Add RESVVT–0
1.6	Add RESVVT–1
1.6	Add RESVVT–2Z
1.6	Add RESVVT–3
1.6	Add RESVVT–4
1.6	Change SSBASB to SSBASB–1
1.6	Change SSFCOR to SSFCOR–1
1.12	Under the *Library Function* STORE, change (X, IXIA) to (X, IXAA).
1.12	Under the *Library Function* V, change V(dbt,humrat) to V(dbt,humrat,press). Change the description to read: returns specific volume of air (lb/cuft) as a function of drybulb temperature (F), humidity ratio (lb-water/lb-air), and pressure (in-Hg).

Corrections to the SUPPLEMENT (2.1E) (continued)

In the BDL Section

Page No.	Correction
1.13	For external file operations (PRINT, WRITE, READ, REWIND, ENDFILE) the default file naming is FORnnn (no extension) where nnn is the unit number specified in the function; legal values for nnn are 50 to 999. Files names can be specified by using a SET command; SET FOR050=C:INPUTDATA.TXT causes unit 50 referenced in functions to connected to the file DATA.TXT in the C:INPUT directory. This connection is eliminated by issuing SET FOR050= (a null string after the equals sign eliminates the environment variable.) See the DOE21E and DOE2ENV batch procedure files for examples. For PC versions of DOE-2.1E only: The first executable function file operation cannot be a REWIND; this will result in a unit not connected error message that can be corrected by first READing or WRITEing to allow file connection.
1.40	The metric keywords for DAY–RESET–SCH are not implemented; English units must be used. RESET–SCHEDULEs cannot have the DAY–RESET–SCH embedded within the schedule, you must use a separate DAY–RESET–SCH command.

In the LOADS Section

Page No.	Correction
2.63	Bottom of the example: Change SHADING–SCH to SHADING–SCHEDULE. Change CONDUCT–SCH to CONDUCT–SCHEDULE.
2.88	Remove the sentence that starts, ''The relationship between site...'' correct the line that starts, ''where "space height" is the...'' by changing the word "ttop" to "top" and "devel" to "level".
2.96	Correct the line that starts, ''2-5% lower heating...'' by changing the word "climat" to "climate".
2.97	Last paragraph, change CONSTRUCTION to EXTERIOR–WALL.

In the SYSTEMS Section

Page No.	Correction
3.3	In the Table of Contents for SYSTEMS, starting in the right-hand column, all the page numbers should be decreased by one. That is, VARIOUS CONTROL ENHANCEMENTS starts on p.3.117, not 3.118, Control of Air Flow Rate to Zones starts on p.118, not 3.119. [don't ask!]
3.4	Fourth paragraph, change the word ''mothly'' to ''monthly''

Corrections to the SUPPLEMENT (2.1E) (continued)

In the SYSTEMS Section

Page No.	Correction
3.27	Top of the page, first item HP–SUPP–SOURCE. Last line of the description should read: PLANT), FURNACE, and GAS–HYDRONIC.
3.34	Add a new keyword GLOOP–TEMP–SCH. GLOOP–TEMP–SCH accepts a schedule of ground temperatures in °F with a default of the weather file ground temperatures (or those specified in LOADS).
3.34	Add the codeword FROM–GROUND to the HP–LOOP–HEATING and HP–LOOP–COOLING keywords. FROM–GROUND allows you to specify that the supply water temperature to the loop is set equal to the current month weather file (or LOADS specified) ground temperature or alternatively uses the value specified by the hourly value of the new schedule keyword GLOOP–TEMP–SCH (schedule is given a value in °F that is used as the loop supply temperature).
3.59,60	Note that the keyword WASTE–HEAT–USE must be set to SPACE–HEAT+DHW for the GAS–HEAT–PUMP to supply waste heat to the DHW–TYPE = WASTE–HEAT or DESUPERHEAT unit; this is the default for systems without GAS–HEAT–PUMP specified. Also add PSZ, PMZS, PVAVS, and PVVT to the types of systems that can have a DHW–TYPE = DESUPERHEAT; in these cases the desuperheater is only used when the DX unit is in the cooling mode (no HEAT–PUMP desuperheater available.)
3.64	Under SYSTEM–EQUIPMENT, Change the code-word ''DIRECT–DIRECT'' to ''INDIRECT–DIRECT''.
3.65	Under SYSTEM–AIR, add this sentence to the description for MIN–OUTSIDE–AIR: If you want to modify the value o the amount of outside air in the system, in order to reduce outside air during unoccupied hours, use MIN–AIR–SCH.
3.84	Under SYSTEM–EQUIPMENT, the description for keyword CONDENSER–TYPE should read as follows: accepts code-words AIR–COOLED (the default), EVAP–PRECOOLED (for PSZ, PMZS, PVAVS, PVVT, PTAC and RESYS systems), or WATER–COOLED (for PSZ, PVAVS, and PVVT systems).
3.101	Top of the page, first item FAN–SCHEDULE. Second sentence should read: If the hourly value is 1, the fans are on.
3.121	Paragraph 1, line 4, change ''hae'' to ''had''

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Corrections to the SUPPLEMENT (2.1E) (continued)

In the SYSTEMS Section

Page No.	Correction
3.130	Under Step 5., second paragraph, last line, change the word "though" to "through".
3.131	Under Step 7., change OA–CFM/PERSON to OA–CFM/PER.
3.132	Under Step 12., first line should read: Calculate the default value, using the greater value, of MIN–CFM–RATIO for variable air volume systems.

In the PLANT Section

Page No.	Correction
4.4	In the example, under both GASCL and OTHER = UTILITY–RATE, change the word METER to METERS.
4.7	In the table, under Metric Default UNIT Values for ENERGY–RESOURCE, change Btu to Wh under the ENERGY–UNIT column.
4.9	Change ABSORG–FUEL–XEFF to ABSORG–HEAT–XEFF.
4.39	Under TWR–DESIGN–APPROACH, last sentence should read: of TWR–CAP–CTRL and the temperature setpoint.
4.39	Under the code-word *FIXED*, second sentence should read: TWR–SETPT–T. Tower capacity adjusts according
4.47	Remove the keywords COGEN–TRACK–MODE, COGEN–TRACK–SCH, MIN–TRACK–LOAD, DIESEL–TRACK–MODE, and DBUN–MIN–HEAT.
4.47	Paragraph at the bottom of this page starting with, *Note: The freedom to choose...* should be moved to the bottom of page 4.48.
4.81	ABSOR1–HIR–FPLR, change curve type from CUBIC to QUAD ABSOR2–HIR–FPLR, change curve type from CUBIC to QUAD

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Corrections to the SUPPLEMENT (2.1E) (continued)

In the ECONOMICS Section

Page No.	Correction
5.8	The name of the keyword BLOCK–CHARGE should be changed to BLOCK–CHARGES. Also, in the keyword description, change BLOCK–CHARGEs to BLOCK–CHARGES.
5.30	Under Example 1, change ENERGY–COST to ENERGY–CHG.
5.32	Under Example 4, change the ENERGY–CHGS line to: ENERGY–CHG = 0.05
5.40	Under Example 8, remove the line that starts with ETC.

In Appendix A

Page No.	Correction
A.2	Variable List Number 17 WNDSPD, add this sentence: See Variable Number 58, VARIABLE–TYPE = uname of SPACE, for wind speed at building.
A.3	Variable List Number 39, change the FORTRAN variable name from IMON to IMO
A.5	Variable List Number 6 BLDDTH(6), description should read: Building Heating load from solar radiation through exterior windows.
A.6	Variable List Number 24 BLDDTC(6), description should read: Building Heating load from solar radiation through exterior windows.
A.7	Variable List Number 14 QSOL, description should read: Glass solar gain (from exterior windows only)
A.8	Variable List Number 33 QSOL, description should read: Glass solar load (from exterior windows only)

Corrections to the SUPPLEMENT (2.1E) (continued)

In Appendix A (continued)

Page No.	Correction
A.10	Variable List Number 16 BG, add this sentence to the end of the description: (This is **not** equal to the ground diffuse solar radiation incident on the wall.)
A.10	Variable List Number 18 RDIF, description should read: Intensity of diffuse solar radiation on the surface from the sky and ground, *after* shading (Btu/hr-ft^2) incident on the wall.
A.11	Variable List Number 2 TDIR, add this sentence: If SHADING–COEF is specified, equals direct transmission coefficient of 1/8" clear reference glass.
A.11	Variable List Number 3 ADIRO, add this sentence: If SHADING–COEF is specified, equals direct absorption coefficient of 1/8" clear reference glass.
A.11	Variable List Number 4 TDIF, add this sentence: If SHADING–COEF is specified, equals diffuse transmission coefficient of 1/8" clear reference glass.
A.11	Variable List Number 5 ADIFO, add this sentence: If SHADING–COEF is specified, equals diffuse absorption coefficient of 1/8" clear reference glass.
A.11	Variable List Number 6 ADIRI, add this sentence: Zero if SHADING–COEF is specified or single pane.
A.11	Variable List Number 7 ADIRI, add this sentence: Zero if SHADING–COEF is specified or single pane.
A.11	Variable List Number 8 FI, add this sentence: Zero if SHADING–COEF is specified or single pane.

Corrections to the SUPPLEMENT (2.1E) (continued)

In Appendix A (continued)

Page No.	Correction
A.13	Variable List Number 24 <ILLUMW>$_1$ [FW has comments?]
A.13	Variable List Number 25 <ILLUMW>$_2$ [FW has comments?]
A.17	Variable List Number 14, remove the word ''design'' from the description.
A.31	In the description change (°F) to (%).
A.49	Variable List Number 38, change the FORTRAN variable name from ETEMPR to FTEMPR.
A.49	Add the following new items for VARIABLE–TYPE = u-name of a PLANT–ASSIGNMENT: Variable List Number 41 - New FORTRAN variable QHLUPN Net heat added to loop (from PLANT, boiler, or ground). Variable List Number 42 - New FORTRAN variable QCLUPN Net heat rejected from loop (from PLANT, tower, or ground).
A.59	Variable List Number 3, change FORTRAN variable name from ENGYLD(3,IHR) to SYSKW. In the description, change (Btu/hr) to (kW)
A.59	Variable List Number 10, change FORTRAN variable name from PDEM(3) to PDEM(3)*KWH/BTU. In the description, change (Btu/hr) to (kW)